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Make it simple: encouraging recycling and waste reduction behavior in an apartment complex

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MAKE IT SIMPLE:
ENCOURAGING RECYCLING AND WASTE REDUCTION BEHAVIOR IN AN APARTMENT COMPLEX

by

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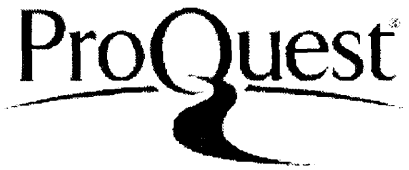

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Make It Simple: Encouraging Recycling and Waste Reduction Behavior in an Apartment Complex.

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In order to confront the growing problem of excessive household waste **this project intended to demonstrate the viability of a waste reduction/recycling program at an apartment complex in Missoula**. The goal of the study was to show that an effective waste reduction information campaign combined with a recycling pickup service would reduce overall waste disposal costs while providing an environmental benefit to the city of Missoula. Using methods gleaned from environmental psychology studies in behavior change I created a waste reduction/recycling program that increased the convenience of recycling, provided simple action strategies for reducing household waste and included persuasive incentives for apartment residents to participate. Specifically, the program provided conveniently located recycling bins for the apartment residents to utilize. Recycling was promoted by providing residents with clear instructions on how, where and what to recycle. A brochure containing easily achievable waste reduction tips was delivered to each household. Detailed information was also provided on the beneficial environmental effects of waste reduction and recycling in Missoula, highlighting the efficacy of individual efforts. In addition to the environmental benefits incurred by diverting waste from the landfill, it was intended that the waste reduction and recycling program would lead to cost-savings in garbage pickup at the apartment complex. While the amount of garbage collected at the complex did decrease, the difference was not large enough to generate substantial cost-savings at this time. The program was designed to be replicable at any apartment complex in Missoula.

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Table of Contents

	Page Number
Abstract	ii
Acknowledgements	iii
Table of Contents	iv
List of Tables	v
List of Figures	v
Chapter 1: Introduction	1
Why I Chose To Do This Project	1
Why Is Garbage A Problem	1
How Much Garbage Do We Produce	2
The Need For Federal Legislation	3
Solid Waste Management in Montana	6
The Need for Integrated Waste Management	9
Impact of Voluntary Efforts	11
Chapter 2: Behavior Change Literature Review	12
Barriers to Recycling	17
Barriers to Waste Reduction Behavior	21
Motives for Recycling	24
Motives for Waste Reduction Behavior	28
Applied Behavior Analysis in Action: Removing Barriers and Enhancing Motives for Recycling	30
Removing Barriers and Enhancing Motives for Waste Reduction Behavior	41
Chapter 3: Study Design	47
Scope of the Project: Choosing an Audience	47
Designing the Study	50
Data Collection Methods	54
Chapter 4: Results & Analysis	56
Results	56
Analysis	62
Chapter 5: Conclusion	66
Appendix A: How to Recycle/Why Recycle in Missoula	71
Appendix B: Notice to Tenants	73
Appendix C: Feedback Notice	74
Appendix D: Shrink Your Garbage - Waste Reduction Brochure	75
Appendix E: Reduce Junk Mail Postcard	77
Bibliography	78

List of Tables

	Page Number
Table 1: Observed Weekly Dumpster Volumes	59
Table 2: Average Weekly Dumpster Volumes	60
Table 3: Observed Recycling Volumes	61

List of Figures

Figure 1: Site Photos	49
Figure 2: Average Weekly Dumpster Volumes at Rozale Apartments and Control Site	60
Figure 3: Project Costs and Potential Savings From Reducing Waste	65

Chapter 1: Introduction

Why I Chose to Do this Project

As an academic effort, this project evaluated the effectiveness of an effort to change individual behavior. Many psychological and sociological studies have been conducted to assess methods of environmental behavior change, yet few methods seem to be applied beyond university walls. This project attempted to apply the techniques in a residential setting in Missoula. Beyond the assessment of these techniques, this project was designed to leave a small part of the community with a lasting change: seven cubic yards of recyclable material weighing more than half a ton were recovered which would otherwise have been landfilled; approximately 25 people were educated or at least exposed to information about the benefits of recycling and waste reduction and a replicable design for an apartment complex program was created for Missoula Valley Recycling to aid them in gaining more apartment complex customers.

Why is Garbage a Problem?

Most people don't think too much about the garbage they produce every day. There is an "out of sight, out of mind" attitude towards garbage as soon as it reaches the garbage can out back. At the community level, a similar attitude is found. Solid waste management is an issue that doesn't make the political agenda until it reaches a crisis level. Often a community will suddenly find it has too much garbage and seemingly nowhere to put it. Of course, the waste industry corporations tell us that there always will be some place to put it; the problem is really the cost. When local options for waste disposal dry up, the

costs for dumping garbage elsewhere begin to skyrocket. The solution to this crisis is that we need to produce less garbage. In ironic contrast however, every year we continue to produce more.

How Much Garbage Do We Produce?

In the last 40 years the generation of municipal solid waste (MSW) in the U.S. has increased from 88.1 million tons of garbage produced in 1960 to nearly 210 million tons in 1996, an increase of 137% (Franklin Associates, 1997). This is partly due to the growing population in this country but the amount of garbage we produce individually is also growing. National per capita rates of garbage produced have increased from a mere 2.75 lbs per day in 1920 to approximately 4.4 lbs per day in 1995 (Melosi, 1981, Franklin Associates, 1997). Much of the increase in per capita waste production can be attributed to cultural and commercial changes in lifestyle. After World War I the automotive, electrical and chemical industries grew rapidly, shifting the economy away from the its previously service-oriented base. Factories were automated, reducing the need for skilled labor and local craftsmen. This trend in the economy continued with renewed effort after World War II, with an increased production and consumption of household goods. This led to the appearance of different types of paper, plastic and other synthetic goods designed to be disposable for greater convenience. These nondurable goods added to an increase in garbage generation as they were designed to be thrown away after use. For example, beverage containers were redesigned as single-use disposable models as opposed to the prior trend of returnable, refillable containers. The packaging industry also showed unprecedented growth with the rise of "self-service merchandising." This

meant that packaging itself was designed not only to contain the product but to advertise the product as well. New kinds of packaging were designed to protect products from damage, and reduce theft from stores. Some of the largest users of packaging materials today are the food and beverage and the cleaning products industries (Kovacs, 1988).

While some forms of packaging can be useful for years, the majority of packaging produced is disposed of immediately. On average, consumers throw out approximately ninety percent of the packaging material they consume each year (Kovacs, 1988). Therefore, the increase in the production of packaging material has had a significant effect on the amount of waste produced in the United States. Since 1960, disposal of containers and other packaging materials has increased by 150%, from 27.3 million tons to 69.2 million tons in 1996 (Franklin Associates, 1997). Today, containers and packaging materials account for 33% of all MSW generated in the United States.

Nondurable goods are the second largest segment of products found in MSW. As defined by the EPA, nondurable goods are those items with a lifetime of three years or less. They include disposable items such as newspapers, paper and plastic tableware, third-class mail and diapers. This category of waste increased 220% since 1960, from 17.3 million tons of nondurable goods to 55.7 million tons in 1996. Nondurable goods represent 26.5% of MSW generated in the U.S. today (Franklin Associates, 1997).

The Need for Federal Legislation

As the amounts of garbage being generated increased, landfills were reaching their capacity faster and new landfills were needed. Particularly with the growth of suburbs,

new sites for landfills were becoming more difficult to find. This became especially true due to greater public awareness that existing landfills were both health hazards and major sources of pollution to streams and groundwater. It became clear that federal legislation was necessary to regulate solid waste and its disposal. In 1965, the first solid waste law, the Solid Waste Disposal Act (SWDA) was passed. This Act recognized the rising fears of landfills reaching capacity and recommended action be taken to assess the problem and suggest some solutions. The Act did not contain regulations, it was mostly an act to provide grant monies to study the problem. Publication of reports that were funded by the Act however, led to passage of additional legislation. In 1976, Congress passed the Resource Conservation and Recovery Act (RCRA). This Act, comprised of amendments to the original SWDA, laid the groundwork for creating regulations of waste transport and disposal. RCRA is best known for its strict regulations of hazardous solid waste which have helped control the transport and disposal of hazardous wastes significantly. A subpart of RCRA known as Subtitle D however, exclusively deals with municipal solid waste. Subtitle D authorized the EPA to create an Office of Solid Waste whose purpose would be to create a national system for managing solid waste. This task included a specific goal of phasing out open garbage dumps, long known to have disastrous environmental impacts and a directive to promulgate "guidelines for solid waste collection, transport, separation, recovery and disposal practices and systems." (42 U.S.C.A. 6902 (a) (8)) Creating these guidelines was no easy task given the opposition by numerous stakeholders who had previously participated in an unregulated industry. The EPA was already trying to comply with the many requirements for regulating hazardous waste. These requirements, mandated by RCRA, often took priority over the

Subtitle D guidelines. By 1984, Congress decided that amendments to RCRA were necessary to redirect methods of waste management. RCRA had left open several loopholes that allowed for unregulated hazardous waste. There were also concerns about the slow pace at which the EPA was acting on the previous RCRA mandates. To address these issues another set of amendments were passed by Congress, known as the Hazardous and Solid Waste Amendments (HWSA). These amendments were deemed necessary to induce the EPA to act on the RCRA amendments in a more timely manner. The HWSA included "hammer" provisions that set deadlines by which EPA had to complete the rulemaking process. According to Lee Thomas, then EPA Assistant Administrator for Solid Waste and Emergency Response, these deadlines "presented an overwhelming management problem" (Ward, 1984). Thus, despite the hammer provisions, it was not until 1991, three and a half years after the deadlines set by the HWSA, that the EPA finally published the Subtitle D municipal solid waste landfill criteria. These criteria established management procedures as well as safety and pollution prevention measures. It also established a post-closure procedure to handle effects of closed landfills still capable of producing pollution. The published criteria gave landfills until 1997 to comply with all the regulations. It became obvious, however, that up to three quarters of the existing landfills would not be able to meet the new standards.

By the time the landfill criteria were published, there were no surprises for the industry or the municipalities involved. In fact they had been preparing for years based on previously distributed drafts of the criteria. The original garbage crisis inspired by a

perceived shortage of landfill space was being greatly exacerbated by the number of landfills that were anticipated to close. Meanwhile more and more waste was being produced each year with no end to that trend in sight. Small towns with inferior landfills had the most to lose as they often lacked the funds to upgrade their facilities. The waste industry however had the advantage as they had the resources to retrofit old landfills and build new facilities. They also saw the new criteria (and the disadvantaged small towns) as an opportunity for new business. By building new "state of the art" landfills, they could attract business from a wide area of towns which would no longer be able to use their own facilities. The predicted landfill shortage was solved almost before it began.

Solid Waste Management in Montana

The publication of the Subtitle D landfill criteria had a predictable but significant effect on waste disposal in Montana. In 1978 there were approximately 186 operating landfills in Montana. By 1991, only 36 landfills which could meet the strict criteria remained open (EQC, 1996). Many of the landfills that closed were owned by small towns. When these closed, contracts were made with the larger regional landfills, owned mostly by waste industry corporations.

One of these 36 remaining landfills is in Missoula and is owned and operated by Browning Ferris Industries (BFI). It is a relatively large landfill, approximately 141 acres in size. The landfill was opened in 1968 by the City Disposal Company. BFI purchased the facility in 1979. At the time, the landfill's two cells were unlined. In 1992, on the heels of the publication of the landfill criteria, BFI commenced construction of two new

cells, complete with the required plastic liners, leachate collection systems, landfill gas collection systems and groundwater monitoring wells. At the same time, BFI began closure and capping operations for the two unlined cells. Since then BFI has excavated two more cells with a plan to create an additional cell in 2002 (Hagen, 1999). It will be many years before the landfill fills to capacity, but exactly how many is difficult to predict. In 1994, the prevailing estimate was that there were approximately 50 years of capacity left (Carroll, 1994). Two years later, in 1996 the estimate was reported as a more conservative 30-50 years left (Merriam, 1996). The most recent prediction is just 25 years, at current rates of disposal (Allison-Bunnell 1999). This last prediction may still be overly optimistic given the ever-changing state of waste disposal.

Missoula's landfill is a regional waste collection facility. It receives waste from most towns and municipalities within a 150 mile radius. Until recently, the landfill was one of only three landfills in Western Montana. Then in January 2000, the county commissioners of nearby Lake County made the decision to close the county-owned landfill which had filled to capacity. (It was decided that augmenting the size of the existing landfill would be too expensive.) All of the waste from Lake County, estimated at 28-37,000 tons per year, will now be disposed in the BFI landfill in Missoula (Stromnes, 2000). The Missoula landfill also accepts waste from other states including Idaho and Wyoming. A major component of out of state waste is used tires. Montana is one of the few states in the West which does not ban landfilling of used tires. This means that the Missoula landfill receives a truck load of tires almost every day (Allison-Bunnell, 1999). The tipping fee for the Missoula landfill at $20/ton is also relatively low

compared to other places around the nation. Rates have reached as high as $112/ton in some Northeastern towns (USEPA, 1999b). The low tipping fee makes Missoula an attractive endpoint for municipal waste for counties without local disposal facilities. A realistic prediction of the impact of out-of-state waste is almost impossible to calculate. While there is no landfill space crisis in Missoula today, there is no question that the landfill will one day fill to capacity and an alternative will need to be found.

According to Jim Leiter, the manager at the Missoula landfill, there are two likely options when the landfill reaches capacity. The first option is to increase the current size by digging a new cell on adjacent land. While BFI would like to purchase nearby land, the price is currently too high (Hagen, 1999). The second option is to build a transfer station and ship the waste to a larger regional landfill on the Columbia River (Allison-Bunnell, 1999). Both of these options will be extremely expensive for BFI. Chances are those costs will be passed on to Missoula citizens in the form of raised garbage collection fees. The fee increase could be significant for commercial customers, such as apartment complexes which produce large amounts of waste. While there are no current estimates of the actual cost of either of these options, one can compare the recently calculated cost of expanding the Lake County landfill to gain a perspective. Adding approximately seven years of landfill life in Lake County, at 27-38,000 tons of waste per year, would cost approximately $1.9 million (Stromnes, 2000). The BFI landfill in Missoula receives about 237,000 tons of waste a year, approximately 10 times as much waste. The cost to add a significant number of years to this landfill would be astronomical.

The Need for Integrated Waste Management

One solution to avoiding these costs, or at least to delaying them as long as possible, is for Missoula to significantly reduce the amount of waste it currently sends to the landfill. Strategies for achieving this are rather simple in theory, but more difficult to put into practice. Many cities and counties around the nation, faced with dire situations have successfully reduced their waste. The national municipal solid waste reduction rate (which includes composting and recycling efforts) is 27%. Hundreds of communities have reached rates higher than the national average. Some communities have reached rates as high as 60% and better (EPA, 1999). Significant waste reduction can be done, if it is done correctly. Most often it is achieved through a system of integrated waste management. Integrated waste management is a comprehensive method for managing waste that is comprised of multiple strategies for diverting and preventing solid waste. Waste is first reduced at the source, by changing production processes to avoid the creation of waste. Waste which cannot be avoided, is then managed in a variety of ways - through recycling, composting and reuse. The last resort for waste is to be landfilled or incinerated.

The Montana Legislature quickly recognized the need for a change in its waste management system in 1991, when the impact of the new landfill regulations could no longer be ignored. With the realization that many Montana landfills would be forced to close, the Montana Legislature passed the Integrated Waste Management Act (MCA 75.10.8). This act included a state-wide goal to reduce waste by 25% by 1996. In order

to achieve this goal, five waste management methods were prioritized. They are as follows, in order of importance:

1) Source reduction
2) Reuse
3) Recycling
4) Composting and
5) Landfill disposal or incineration.

The 25% goal was well-intended, and the prioritized list certainly well-founded, but unfortunately the Act lacked any enforcement or mandatory clauses. The 25% goal was not reached in 1996. The best estimates today indicate that the state is only recycling about 5% of its waste, and no estimates exist for composting rates (USEPA, 2000).

An attempt to create an Integrated Waste Management Plan for the city was undertaken in 1993 by the Missoula Solid Waste Task Force. The task force, comprised of city council members, BFI representatives, recycling advocates and other concerned parties, created a draft plan to present to the City Council. The draft plan included an analysis of the current waste management options and a full complement of recommended actions. These actions included extensive city-sponsored education programs, expanded recycling programs, the creation of a solid waste advisory board and an increase in alternative waste services from BFI. Unfortunately the plan was never approved. The greatest stumbling block was the inability of the city council to mandate changes regarding solid waste management. The reason for this is that BFI owns the landfill and is the only licensed garbage hauler in the county. The City could not possibly afford to take over

BFI's operations, and lacked any way to enforce the actions laid out in the plan. Like the Integrated Waste Management Act, The Missoula Solid Waste Management Plan was full of good ideas, but has not come to fruition.

Impact of Voluntary Efforts of Individuals

In the absence of waste reduction mandates through legislation, one must turn to the voluntary efforts of individuals. The roughly 90,000 residents in Missoula county alone produce a great deal of garbage (Oliver, 1997). BFI does not provide data on the amount of household waste generated in Missoula, but an amount can be estimated using national waste generation rates. Assuming a rate of 4.4 lbs per day, the residents of Missoula generate approximately 72,270 tons of garbage in a year; which constitutes about 30% of the yearly intake at the landfill. They are also in control of a considerable amount of the garbage that is produced. The latest estimates show that residential waste comprises 55-65% of municipal solid waste. The remaining 35-45% is generated by commercial sources (Franklin Associates, 1997). Therefore, if Missoulians voluntarily reduce their waste, the remaining capacity of the landfill will be extended. A reduced rate of waste in Missoula will also be an advantage when the landfill does eventually fill. Particularly for BFI's commercial customers, a reduction in the amount of garbage produced will lead directly to cost savings when pickup fees rise. The next question then, is how do you get Missoulians to change their waste-producing behavior? That is the question that will be addressed in this thesis.

Chapter 2: Behavior Change Literature Review

There are two main schools of thought on the best way to achieve behavior change. The first is to attempt, through educational techniques, to change the attitudes and beliefs of a target audience with the hope that the correct behavior will follow. The strength of this school of thought follows from the assumption that education will create a greater awareness of issues leading to changes in attitudes which will ultimately result in improved behavior. Using this theory, it is hoped that if one could teach a preference for a clean and healthy environment, we would see a greater occurrence of environmentally healthy behavior. The second school of thought works specifically on facilitating the desired behavior. This method does not attempt to alter attitudes and beliefs but focuses directly on the barriers and motives for the behavior. For example, instead of trying to persuade people that littering is bad, one could facilitate behavior simply by providing a garbage can in a visible and convenient location.

Many studies have been conducted using the first school of thought. There is a wealth of literature in the realm of environmental education regarding the impact of educational techniques on knowledge and attitudes toward environmental issues. For example, a recent article in the Journal of Environmental Education looked at environmental knowledge and attitudes in high school students in Texas. Four hundred and seventy-five (475) students were tested before and after completing an environmental science course. The course clearly had a positive effect on the student's knowledge of environmental issues. Environmental knowledge test scores were an average of 22% higher after taking the course. The course had a more modest effect on environmental attitudes. These

attitudes were measured using an attitude inventory scale. Results showed an average increase of 2%, indicating slightly more positive attitudes toward the environment after taking the course. The authors discuss these results as a significant measure towards using education to solve environmental problems. The authors state,

> It has long been known that the basis for many environmental problems and issues is irresponsible environmental behavior. Without doubt, one of the most important influences on behavior is attitude (Bradley, et al., 1999).

There is little to disagree with in these statements. Irresponsible behavior is certainly one cause of environmental problems. Attitude is also a significant influence on behavior. The assumption the authors are making, however, is that a change in attitude will lead to a change in behavior. This assumption is misleading. Attitude plays a role in behavior but it may not be a strong enough role to overcome physical or situational obstacles which also determine behavior. In fact, inconsistencies between attitudes and behavior have been found repeatedly in sociological studies. As early as 1969, sociologist Howard Ehrlich wrote,

> Studies on the relation between attitudes and behavior have almost consistently resulted in the conclusion that attitudes are a poor predictor of behavior (Ehrlich, 1969).

While Ehrlich's research focused predominantly on the study of ethnic prejudice and intergroup behavior, a similar statement can be made for environmental education efforts. For example, the latest national Gallup Poll on environmental issues found that 83% of Americans "agree with the goals of the environmental movement." Of the 83%, however, only 16% claim to be "active" in the movement (Gallup, 2000). When one looks at a specific environmental behavior such as recycling, the results are virtually the same. Researchers have repeatedly found the same positive environmental attitudes

shared by both recyclers and nonrecyclers. For example, over one thousand residents of Alberta were interviewed about their attitudes toward the environment and their participation in recycling programs. Eighty-nine percent (89%) of the respondents expressed "some degree of concern about the environment." Forty-nine percent (46.9%) indicated that they were "very concerned" about the environment. When attitudes were compared to behaviors, mean level of concern showed only a very weak positive correlation to participation in recycling programs (Derksen and Gartrell, 1993).

In a Broome County, NY study, survey respondents were asked about their attitudes toward the environment and their respective recycling habits. Results of this study showed that 95% of those who recycled accepted that quality of the environment was important. However, 88% of nonrecyclers also felt the same way (Lansana, 1992) A weakness of both of these studies is that they were looking at reported recycling behavior. It is likely that non-recyclers may have reported themselves as recyclers because recycling is often seen as the "right thing to do".

Raymond DeYoung, a researcher in Ann Arbor, MI, eliminated this potential bias by conducting a study on attitudinal differences using observed recycling behavior. In this study, over 2,000 households were observed over a three month period to determine if they participated in the city's curbside recycling program. To do this, a researcher traveled with the recycling pickup truck for three months and recorded the level of participation at each home. Two-hundred (200) of the households were then randomly selected to be contacted for a telephone survey. The survey assessed conservation attitudes, motivations and satisfactions derived from behaviors. The survey included a

scale designed to reflect a pro-recycling attitude. When comparing the answers of observed recyclers with those who did not recycle, no difference could be found in terms of pro-recycling attitudes. In fact, almost all respondents showed a favorable response towards recycling. Clearly the favorable attitude could not predict recycling participation (DeYoung, 1988-89). It is likely in Missoula the same results would be found. Although no studies have been conducted using observed recycling behavior, a telephone survey conducted by MontPIRG in 1991 showed that reported recycling behavior was not determined by attitudes toward recycling. The results of the survey showed that 93% of reported non-recyclers "recognized recycling as beneficial", even though they were not participating in the activity. (Carroll, 1992, MontPIRG, 1992). It appears that when actual behavior change is the goal, an effort to simply change attitudes will not be sufficient. As Joseph Hopper, a sociologist at the University of Colorado at Boulder, said, "We do not need to convince people that recycling is a good idea, rather we need to persuade them to behave accordingly" (Hopper, 1991).

This leads us back to the second school of thought in behavior change which is often called applied behavior analysis or behavioral engineering. This is the method of behavior change I have chosen to use in this study. Applied behavior analysis involves manipulating the stimuli in a person's environment to best facilitate engagement in the target behavior. One definition explains it this way,

> Behavioral engineering is an approach toward behavior change that focuses on arranging the environment (i.e. behavioral antecedents or consequences) so as to increase the possibility of desired behaviors and decrease the probability of undesired behaviors. (Geller, 1987)

Behavioral antecedents are reminders, instructions, or other helpful tools provided to encourage the behavior. Consequence techniques involve the use of rewards or punishments delivered after a behavior is performed.

To find the most useful methods, one must look closely at the target audience whose behavior you are trying to change. The first aspect to look at is the demographics of the population you are trying to change. While you cannot change a person's demographic, it is helpful to focus efforts on target audiences which will be most amenable to the behavior. Especially in setting up a pilot recycling program it is important to know if your target audience has a likelihood of success. Much research has been done to determine what kind of person is most likely to recycle. As it turns out, the results have been inconsistent and often conflicting. For example, the effect of age on recycling behavior has been studied by several researchers. Some studies showed an increase in recycling behavior with age (Vining, 1990; Lansana, 1992; Derksen, 1993, Scott, 1999). But others found either no correlation with age at all (Oskamp, 1991; Werner, 1998) or an increase seen in younger populations (Gamba, 1994). Similar results were found when education levels were examined. Higher education levels led to increased recycling behavior in two studies (Lansana, 1992; Derksen, 1993). No correlation with education level was found in many other studies (Hopper, 1991; Vining, 1990; Oskamp, 1991; Gamba, 1994, Werner, 1998; Oskamp, 1998; Scott, 1999). Income level was another factor often examined in recycling studies. Four studies found that people with higher incomes tended to recycle more often than those with lower incomes (Jacobs, 1984; Vining, 1990; Oskamp, 1991; Gamba, 1994). And in response four studies found

no correlation at all between income and recycling behavior (Derksen, 1993, Werner, 1998; Oskamp, 1998; Scott, 1999). The best that can be said in examining these data is that the links between recycling behavior and demographics are ambiguous. The diversity of the populations targeted in the various studies varied widely. Some studies were conducted in neighborhoods with fairly homogenous populations, while others compared groups from different backgrounds. Some studies relied on survey techniques to measure self-reported recycling behavior while others actually observed and recorded the recycling activity. It appears, however, that the demographics of a population are not helpful in determining a potentially successful target audience for a recycling project.

Barriers to Recycling

The next step in applied behavior analysis is to identify the major barriers that exist which prevent a person from participating in the target behavior. A great deal of research has been conducted on this in recent years. The number one barrier to recycling is the inconvenience or nuisance associated with the task. Most studies indicate this, including a study by Werner and Makela (1998) who surveyed 300 homes in a downtown urban area. Their questionnaire included open-ended questions about recycling behavior such as, "What - if anything - interferes with recycling in your household?" The most common responses to this question reflected concerns of "mess, lack of storage space" and "lack of convenient pick-up/drop-off" for recycling. Other answers included not having enough time to recycle, difficulty remembering when to recycle and that recycling is just too difficult. Many other studies reinforce Werner and Makela's findings. Margai (1997) found that many inner city respondents to a recycling survey complained most

about the distance they had to take their recyclables as compared to the conveniently located garbage chutes. Students in Chicago also indicated that inconvenience was an important reason for not recycling, specifically stating a dissatisfaction that recycling was not picked up at the curbside along with their garbage (Howenstine, 1993). DeYoung (1988-89) distributed a questionnaire that assessed perceived difficulty of recycling. The questionnaire measured inconvenience related to storage and sorting of recyclables as well as awareness of which items can be recycled. He found that non-recyclers perceived recycling to be more difficult than recyclers did. This perception likely played a role in the non-recyclers lack of participation. These studies all reflect the general inconvenience associated with recycling. It is simply easier to dispose of garbage into a single conveniently located receptacle like a trash can than have to worry about rinsing, sorting and transporting the materials to a recycling center. While this increased inconvenience will always occur to some degree, it is likely that recycling participation will increase when the inconvenience is lessened.

The next most important barrier to recycling is the simple lack of information on how to recycle. This includes the basics - which items can be recycled, how to prepare the materials, where they must be taken, and when. Often a recycling service has different rules and procedures than the local garbage service. These rules vary from place to place, and often change over time. It can be difficult to keep informed of all the current rules, and not having the right information can be a barrier to being able to participate. DeYoung looked at the effect of accurate information in carrying out a behavior like recycling. He states,

> Any time one is not sure what to do next, one is easily overwhelmed. A simple activity becomes a major hassle...Faced with such a situation, people will avoid attempting to begin an activity regardless of their attitudes and opinions. (DeYoung, 1988-89)

Simmons and Widmar distributed a questionnaire which also looked at the role of information in recycling participation. Specifically, their questionnaire assessed one's confidence in their knowledge of their local recycling program. The questionnaire used a 5 point Likert scale (where 1 indicated strongly disagree and 5 represented strongly agree) and included items such as "I am not sure what can be recycled." And "I am not sure how to recycle my household goods." The overall mean scores for these items was 2.36 indicating that the average respondent had only a modest confidence in his or her knowledge of local recycling practices. The researchers then divided the survey respondents into two groups - those with a weak confidence in their recycling knowledge and those with a strong confidence. They found that those with a strong confidence in knowledge of recycling practices were significantly more likely to recycle than those with a weak confidence. (Simmons and Widmar, 1990a).

Gamba and Oskamp also found that knowledge of recycling rules was strongly related to participation in recycling. In their study they used a questionnaire to assess recycling program knowledge. They asked respondents which materials they believed were recyclable in their town's current program. In addition they observed the surveyed households bi-weekly for two months to measure recycling participation. The results of their analysis revealed that frequent recyclers (those who were observed recycling on 80% or more of pickup days) scored higher on recycling program knowledge than less frequent recyclers. In other words, knowledge of the recycling program was a significant

predictor of greater recycling participation (Gamba & Oskamp, 1994). Similarly, in a study conducted in a Los Angeles suburb several years later, better knowledge of recycling programs was correlated with an increase in the amount of recyclable materials put out for collection (Oskamp et al., 1998). The results of these studies show that those who know how to recycle are more likely to do so. While these results may seem obvious, they provide an important insight into an often overlooked barrier. It appears that many recycling programs may be getting lower participation due to inadequate dissemination of important "how-to" information.

The third major reason for not recycling is a general disbelief in the efficacy of recycling. There are many myths associated with recycling and recycling practices that serve to prevent participation. These myths, often founded on partial information, vary from a general belief that recycling wastes more time and energy than it generates, to local myths that carefully separated recyclables secretly get sent to the landfill anyway. Here in Missoula, both types of myths are present due to a number of factors. For one, Missoula is relatively remote from markets for various recyclable materials. Thus some Missoulians appear to believe that recycling materials here is not worth the costs of transportation to distant markets. For some materials this is certainly true, but those materials are not currently recyclable in Missoula. For example, several types of recyclable plastic are not collected in Missoula due to the cost of transporting them for recycling. On the whole, recycling businesses operate in order to make a profit and, therefore, do not collect materials unless there is a financially feasible market for them. Another fact that many Missoulians are unaware of is that there are local markets for two

recyclable materials, cardboard and glass. All of the cardboard collected in Missoula is taken to the local Smurfit-Stone pulp mill for use in making new linerboard. And as of Spring 2000, glass is collected locally and crushed with gravel for use in backfill and road building projects. (Allison-Bunnell, 2000). The other myth is that BFI garbage trucks which collect recyclables through the Blue Bag system, are in fact landfilling these bags. There are reports of BFI workers tossing the blue bags directly into the same trucks which collect regular garbage. What Missoula residents often don't realize is that many BFI trucks have a double hopper system which means that Blue Bags can be collected by the same truck that picks up garbage but be stored in a separate hopper within the truck for later separation and sorting. Greater publicity of the correct information may help to offset these myths which may prevent recycling behavior.

Barriers to Waste Reduction Behavior

Having identified the three most important barriers to recycling, an equally important goal is to identify the major barriers to other kinds of waste reduction behavior. Waste reduction is a broad category that includes activities such as greater reuse of items in the home, use of durable instead of disposable products, purchasing items that come with less packaging, and buying in bulk. There is, however, considerably less literature that has examined these behaviors and the best ways to encourage them. From the few studies that do exist and analogies that can be made from studies of recycling behavior, the following barriers to waste reduction behavior can be identified.

A major barrier to waste reduction behavior is the general lack of incentive to engage in waste reducing activities. While waste reduction behavior is certainly not new, it is not

readily practiced or encouraged in modern day American culture. Today's waste management systems are structured to manage waste that has been produced and lack the incentives for people to reduce waste. Here in Missoula, the monthly cost for household garbage pickup remains the same regardless of how much garbage is put out for collection.[1] Other cities have established "Pay-As-You-Throw" (PAYT) programs in which one's garbage bill is dependent on the amount of garbage produced. These programs provide an incentive to reduce waste by linking waste generation directly to one's checkbook. PAYT programs have had tremendous success in reducing waste in the United States. In Dover, NH for example, residential waste generation decreased by 24% after the implementation of a PAYT program. Recycling and home composting were identified as less expensive alternatives to throwing away waste and increased significantly in accordance with the new program. A similar success was seen in Chatham, NJ. Average trash disposal costs per household decreased from $350 per year to $157 per year with their PAYT program (USEPA, 1999b). The economic incentive was clearly a major motivator in Chatham.

This direct cause-and-effect connection between waste generation and costs is missing in many communities such as Missoula. Nevertheless, even without the compelling financial benefits of a PAYT program, there are several other benefits to reducing waste. Purchasing household items in bulk is less expensive than buying several smaller containers and reduces overall packaging consumed. Reuse of items saves money in the long run, and saves valuable landfill space as well. Use of durable items saves

[1] BFI does offer a "one-can" rate for those who put out only one can a week for collection. This rate is not widely advertised however, and is only about $1.00 cheaper than the unlimited collection rate.

considerably over the constant repurchase of disposable items, but again the savings are realized over a longer period of time. The savings may not be as obvious to the shopper impressed by the sale on designer paper plates. Similarly one does not always think about the extra environmental costs of our purchases while shopping. A shrink-wrapped Styrofoam tray of pre-sliced cantaloupe at the grocery store looks attractive and may be less expensive than a whole melon. However, the tray and plastic wrap will take up room in a landfill for tens to hundreds of years leaching potentially toxic chemicals into our air and water, whereas the natural packaging of a cantaloupe rind can decompose in a few weeks in a compost pile and will nourish the earth. The barrier to making decisions that can reduce waste is a general lack of appropriate information of the real costs of not reducing waste. Consumers need to be made aware of the impacts their decisions make on both their environment and their pocketbooks.

Thirdly, consumers need procedural knowledge. There is a general lack of information in our culture on how to effectively reduce waste. Even if consumers are aware of the gravity of solid waste problems in their region, they need to be provided with concrete examples of how to go about helping the situation. Without concrete examples of waste reduction behavior that are simple to implement, few people will make the effort to figure out how to change their behavior for the better. In their discussion of a study examining waste reduction behaviors in New Jersey, authors Simmons and Widmar concluded,

> Since solid waste reduction represents a new set of behavior patterns for most people, the residents may lack the necessary imagery and concrete understandings of the connections among behaviors such as using reusable products and the overall reduction of solid waste. Consequently, residents

> may resist venturing into behaviors for which they have insufficient models and social support (Simmons and Widmar, 1990b).

This conclusion is backed up by a study by DeYoung et al. in which Michigan residents were asked about the barriers to reducing the amount of garbage their household generates. The highest rated barrier was a lack of methods to reduce their waste. Other highly rated barriers included the inconvenience of reducing waste and lacking the time needed to reduce waste (DeYoung et al., 1991).

Motives for Recycling

Having examined the barriers to recycling and other waste reduction behavior, it is worthwhile to look at the other side of the coin and study the motives that exist for engaging in these behaviors. The majority of studies that have asked recyclers why they participate in recycling programs reveal that they do so because they believe it is good for the environment. Vining and Ebreo distributed a questionnaire to 500 households in Illinois asking them to rate the importance of a list of reasons for recycling. Environmental concerns including "conservation of energy and natural resources" received the highest rating (Vining and Ebreo, 1990). Several years later, a questionnaire was distributed to over 600 homes in California asking questions about recycling behavior and attitudes. Environmental concern again emerged as the highest scoring reason to recycle (Gamba and Oskamp, 1994). Vining et al. conducted a study assessing motivations to recycle in four different communities in Illinois. The study examined the effect of recycling program status on the motivation to recycle. One of the four communities had a well established curbside recycling program, one had a fairly

new curbside program, another had drop-off service only, while the fourth had no convenient recycling facilities at all. While factors such as social influence and economic concerns varied in their ratings in the different communities, the highest rated factor for recycling was consistent in all four communities. This factor was labeled "altruism". The altruism factor included several environmental reasons such as conservation of energy and natural resources, saving landfill space and desire to reduce litter. (Vining et al., 1992).

Knowledge of the environmental reasons for recycling can lead to a sense of intrinsic satisfaction from engaging in the behavior. Intrinsic satisfaction arose as a strong reason for recycling in many studies, and appears to be a powerful motivator. Werner and Makela asked residents in an urban neighborhood what they found interesting or fun about recycling. While the majority of respondents found nothing interesting or fun about recycling, they did reveal what persuaded them to participate nonetheless. More than 20% of respondents indicated that they were motivated by the personal satisfaction that they were doing something good for the environment (Werner and Makela, 1998). DeYoung closely examined the structure of intrinsic satisfaction that is related to recycling and other environmentally responsible behaviors. He discovered two specific factors which were both closely associated with recycling behavior. The first factor was a specific satisfaction derived from being efficient and frugal. Questionnaire items related to this factor asked if satisfaction was derived from "finding ways to avoid waste" and "repairing things rather than discarding". The second factor was a satisfaction from participating in a beneficial activity. This factor included

questionnaire items assessing satisfaction from "a chance to do things that make a difference", "participation in activities involving the community" and "participation in bringing sense/order to the world". Both factors were positively correlated with self-reported recycling behavior (DeYoung, 1986).

The satisfaction from engaging in environmentally responsible behavior is strongest in those who believe that their individual actions are in fact making a positive contribution to the health of the environment. A mail questionnaire study in California asked residents how effective they believed recycling to be as a way to reduce garbage. Overall, 83% of the respondents believed that recycling was "very or extremely effective." When they correlated these beliefs with reported recycling behavior, they found a significant correlation. Those who strongly believed in the efficacy of recycling were much more likely to recycle (Gamba and Oskamp, 1994). Simmons and Widmar conducted a similar questionnaire study in New Jersey. Their questionnaire assessed whether respondents had a lack of "personal salience and efficacy" in influencing solid waste matters. They also found a significant effect. Those with a strong lack of personal salience and efficacy were much less likely to recycle. This held true even for those respondents who indicated they had a strong conservation ethic (Simmons and Widmar, 1990a). Hines et al. produced a meta-analysis of studies that examined a variety of environmentally responsible behaviors, including recycling. In this study they isolated a factor they called "locus of control" which represented "an individual's perception of whether or not he or she has the ability to bring about change through his or her own behavior." Again, the combined results of fifteen studies showed that those with a strong

internal locus of control were significantly more likely to behave in an environmentally responsible way (Hines et al., 1986/87). Therefore, convincing the public of the efficacy of their individual actions may well be an effective way to encourage appropriate behaviors.

Additional motivation for recycling comes from social pressure around the recycler. Particularly when recycling is a highly visible activity, i.e. when recycling bins are put out for collection at the curb, there is pressure to conform to the norm on the block. When survey respondents were asked why they recycle, researchers found that social pressure from friends and family was a highly rated reason (Gamba and Oskamp, 1994, Scott, 1999). It appears that people are heavily influenced by the actions of those they interact with most. This was shown in a telephone interview study conducted in California. The surveyors found that having friends and neighbors who recycled was a significant predictor of recycling behavior (Oskamp, 1995).

Finally, a recurring reason for recycling that is mentioned in many studies is an economic incentive to recycle. This incentive varies widely between communities based on the financial remuneration opportunities available for recycling. In communities with PAYT programs, the financial benefits of recycling can be seen in the avoided costs of additional garbage pickup. In other communities, recycling drop-off centers often pay for recyclable materials by the pound. Still other communities offer raffles and prize incentives for those who participate in the local recycling program. Not surprisingly, financial reward was mentioned as a motivation to recycle in several studies (Scott, 1999,

Simmons and Widmar, 1990a, Vining and Ebreo, 1990; Vining, et al., 1992; Gamba and Oskamp, 1994). The financial motivation was never found to be particularly strong. In all cases, concern for the environment proved to be a stronger motivator than financial reward. The likely reason for this is that the money one can make by participating in recycling is usually quite nominal. Recycling buyback centers are often at the mercy of rapidly fluctuating prices for recyclable materials. When the purchase price they can offer for a certain material drops too low, there is less incentive to collect and return that material. Here in Missoula, buy-back centers do exist, and prices tend to be low. Many people drop-off their recyclables without stopping to get paid for them, indicating that the prices are too low to bother going inside to get the materials weighed. Other residents have recycling services which pick up their recyclables either for free or for a fee, with no option to be repaid for the value of the materials collected. Financial considerations while present, are clearly not a major motivator in Missoula. This was confirmed by a telephone interview study conducted by MontPIRG in 1992. Results of this study showed that only 15% of Missoulians responded that money was the number one reason that they recycle, whereas nearly 78% gave environmental considerations (saving landfill space, resources and energy etc.) as their primary reason to recycle (Carroll, 1992).

Motives for Waste Reduction Behavior

Many of the motives for recycling also exist for engaging in other types of waste reduction behavior. The most motivating reason to reduce waste, is to do so for the good of the environment. One study assessing motives to reduce waste found that the most

highly rated reasons for reducing waste were "it saves landfill space", "it saves natural resources" and "it reduces the toxicity of waste" (DeYoung et al. 1991). It appears that intrinsic satisfaction derived from engaging in waste reduction behavior is also a powerful motive. In the same study that examined intrinsic satisfaction and recycling behavior, DeYoung examined "reusing behavior" which is another form of waste reduction behavior. He found that satisfaction from frugality was closely correlated with reported reusing behavior, such as reusing old cloth as rags, reusing aluminum foil, and saving food containers for other uses (DeYoung, 1986). In a follow-up study, DeYoung examined a greater variety of waste reduction behavior including reusing, purchasing of less packaged goods, buying in bulk, and decreasing use of disposable items. In this study he found a correlation between these behaviors and both satisfaction from frugality as well as satisfaction from participation (DeYoung, 1996).

Unlike recycling behavior, financial considerations may well be a significant motive for engaging in other types of waste reduction behavior. A large part of waste reduction can be accomplished by changing one's purchasing behavior. Purchasing durable products instead of disposable items and choosing products that come with less packaging are two important waste reduction strategies. In order to effectively change purchasing behavior, one must carefully consider the costs to the consumer. Marketing research tells us that shoppers do not give much thought to shopping for low-cost convenience goods such as groceries. Price, quality and convenience are the top three factor used in making everyday purchasing decisions (Cornell, 2000; Ottman, 1993). For goods which have many equivalent substitutes, price is usually the most important factor (Keegan et al.,

1992). Informing people of the economic advantages of reducing waste through purchasing behavior may then be an effective tool in changing behavior.

Applied Behavior Analysis in Action: Removing Barriers and Enhancing Motives for Recycling

Once one has outlined the most influential motives and barriers, one can apply the techniques of applied behavior analysis to encourage the behavior. This involves removing the barriers and emphasizing the incentives to the greatest extent possible. The most important barrier to recycling is the relative inconvenience of participation. One effective way to reduce the inconvenience is to reduce the distance between the target audiences home and their recycling location. The effect of distance was noticed by Witmer and Geller in an early recycling study conducted in several multi-floor college dormitories. While the study's purpose was to look at the impacts of raffles and prize incentives on recycling participation, the researchers noticed a consistent pattern among the study's most frequent participators. In each dorm, the residents who lived on the same floor as the recycling collection area comprised the majority of the recycling participants (Witmer and Geller, 1976). In anther study, conducted in an academic building on a college campus, the effect of location of aluminum can recycling bins was investigated. Each floor of the building consisted of a single long hallway with classrooms located on both sides. In the baseline condition, central recycling bins were located in the middle of each hallway. Signs acknowledging the bin locations were placed above garbage cans in each classroom. The investigators counted the number of

cans recycled in the bins each day as well as the number of cans improperly thrown in the classroom garbage cans. In the experimental condition, the bins were removed from the hallway, and placed next to the garbage cans in each classroom. The experimental intervention resulted in a 50% increase in number of cans recycled. When the intervention was removed and the bins were returned to the hallway, the baseline levels of recycling were seen again (Ludwig et al., 1998). Presumably the closer proximity of the bins to the location of the beverage consumption in the classrooms led to the higher recycling rate. It is also likely that the location of the bins next to the garbage cans increased recycling by working in coincidence with a familiar pattern of behavior. If one is used to throwing away a can in the garbage by the door of the classroom it takes minimal effort to throw the can into an adjacent bin. It requires a different pattern of behavior to take the can out of the room with you to dispose of it in the hallway bins.

A comparison can be made to recycling behavior in residential locations. If the recycling bins are located in proximity to garbage containers, the inconvenience of recycling is reduced. Since residents already have an established behavior pattern for throwing away garbage, recycling becomes an easier new behavior to adopt when the behavior pattern is similar. This may explain why community recycling programs with curbside pickup service invariably outperform recycling programs which only offer centralized drop-off recycling centers (USEPA, 1999b). Requiring a person to take their recyclables to a drop-off location they are unfamiliar with presents a hurdle many are unwilling to overcome. In a questionnaire survey conducted in Canada, researchers found that 48% of Toronto residents with curbside recycling service would recycle less if the their service was

removed and they were required to take their recyclables to a drop-off center (Scott, 1999). Another Canadian study showed that residents of Edmonton who had access to a curbside program recycled significantly more types of items than residents of Calgary, a city with drop-off locations only. This result was true even when they considered the resident's level of concern for the environment. The authors concluded that,

> The only important determinant of recycling behavior is access to a structured, institutionalized program that makes recycling easy and convenient (Derksen and Gartrell, 1993).

In an EPA study looking at successful apartment complex recycling programs, all of the model programs selected included recycling bins located on the complex grounds. The study specifically recommended that bins be located in a convenient location close to garbage dumpsters. (USEPA, 1999a). The effectiveness of the location of recycling bins was shown in a newspaper recycling study conducted at an apartment complex. In this study, the apartment complex had a newspaper recycling bin located in the basement laundry room. The researchers weighed the amount of newspaper recycled in the bin each week. Then they introduced two more recycling bins at the complex locating them next to the garbage dumpsters. In this case, a greater than 50% increase was seen in the weight of newspapers recycled. The recycling bins by the dumpsters provided the visual reminder for recycling each time a resident disposed of their garbage. By locating the bins near to the place where garbage disposal regularly took place. the convenience of recycling behavior was increased (Reid et al., 1976). Here in Missoula, most apartment complexes do not employ curbside recycling collection programs. It appears that the implementation of a curbside program might increase recycling at an apartment complex.

Simply having recycling bins in a convenient location will not reduce all the barriers. As discussed above, a second key barrier to engaging in recycling is the lack of applicable information about recycling. This includes information about what materials can be recycled, how they need to be prepared and where to take them to be recycled. Providing clear, easy to understand and readily available information on recycling has proven to increase recycling participation.

In one experiment, residents of a Denver, CO neighborhood with access to an on-going curbside recycling program were studied. One group of residents was given an informational brochure describing the program, the dates of recycling pickup, and the items which could be recycled, while another group received no additional materials. The group receiving the brochure showed a 69% increase in participation in the six months of recycling observation (Hopper and Nielsen, 1991). Other studies have also shown increases in participation after the distribution of instructional materials, although with more modest results. Researchers in California found an 13% increase in amount of recyclables collected after distribution of information on recycling procedures (Oskamp et al, 1995). Jacobs and Bailey (1982-83) noticed a 6.5% increase in newspaper recycling participation in Florida residents when they were given a handbill with instructions for the recycling program.

The discrepancy in results for similar procedures may lie in the quality of the informational brochures distributed. In a study looking at the effectiveness of

instructional signs, Werner et al. (1998) found that the informational content of the signs made a significant difference in promoting recycling behavior. This experiment examined recycling behavior in a college cafeteria. The cafeteria had a recycling program in place for all polystyrene items used in the cafeteria. Signs on the recycling bins asked patrons to deposit clean Styrofoam plates, cups and plastic silverware into the bins. With these signs, only ¼ of a bin of polystyrene was collected each day. In addition, the bins were often contaminated with excess food making recycling of other items in the bin impossible. New signs were put into place in the experimental period. The new signs had larger lettering to attract more attention. The signs also gave specific instructions on which items could be recycled and how to prepare items properly. This included attaching samples of recyclable items to the signs, and explaining that scraping food from plates and bowls would decrease contamination. These few simple instructions were extremely effective resulting in over 3 1/2 uncontaminated bins of recyclable polystyrene collected each day—an increase of 325%. Clearly the providing of specific instructions is a simple and effective tool to overcome barriers which prevent recycling behavior.

Of course the information is only useful when it is readily available. In a review of environmental behavior programs, Ester and Winett found that many studies distributed information just once during the study. While this may be effective initially, the recipients may not always keep the information handy when they need it. Endurance of participation is a problem seen in many studies. A more effective route is to distribute the information repeatedly on a regular basis to keep the information fresh. Another

method is to provide permanent signs near the location where the behavior will take place that can be referred to when the information is needed (Ester and Winett, 1981-82). Providing information on reasons to recycle is also effective in increasing recycling behavior. In this case, clear explanations of the benefits of recycling can enhance the incentive to recycle. As noted before, the most prevalent reason to recycle is for the good of the environment. If information can be provided that elaborates on the beneficial results of recycling, there will be more reason to engage in the behavior. Specifically, if one believes that their individual recycling actions make a difference for the overall good of the environment, this provides a powerful internal incentive to recycle. Lansana conducted a study which assessed both local and general attitudes towards recycling and the environment. She found that the majority of survey respondents believed that quality of the environment was important in general. When it came down to the health of the local county, there was a distinct split in beliefs between recyclers and non-recyclers. 72% of recyclers felt that recycling was necessary for the county, while only 48% of nonrecyclers felt the same way (Lansana, 1992). The belief in a positive effect on the county's solid waste situation added an incentive for many recyclers which helped persuade them to take action. Although not often implemented, it has been recommended by many researchers that the specific local environmental benefits of recycling be demonstrated to the public. As Scott concluded,

> By helping the public make the connection between their contributions at the curb and both community and environmental improvement, social marketing can build on existing motivations to enhance overall waste diversion efforts (Scott, 1999).

An effective method of demonstrating the positive effects of recycling is to provide feedback to recycling participants on the results of their efforts. Feedback can be given in a variety of forms, from a simple thank you note acknowledging participation to a detailed accounting of the quantity of recycled material diverted from the landfill. Feedback messages can be delivered to each doorstep, or posted locally on a community bulletin board or in the newspaper. In any case, feedback works through several mechanisms. Any message from the recycling program organizers can work as an extra reminder to recycle, which can encourage continued participation. Feedback can also express appreciation to recyclers involved in the program providing a reward for the behavior. It is rewarding to know that the efforts being made have been acknowledged. This reward also acts to encourage continued recycling behavior. Lastly, specific feedback on the results of the program act as a much needed consequence of the behavior. Information about where the recycled materials are being used and how much useful material is being collected keeps recyclers informed and enthusiastic about their actions. Without this information, people are more susceptible to doubts about the true efficacy of recycling. A study in Toronto showed this when respondents were asked to give their comments on the city's current Blue Box recycling program. A common response indicated that recyclers were concerned about the fate of the materials they set out for collection. Many residents asked for publication of the results of the recycling program to assuage their worries that cans and newspapers were actually being sent to the landfill (Scott, 1999).

Studies using various feedback techniques have proven to be effective. A review of studies looking at energy conservation behavior showed,

> that providing customers with frequent feedback on their energy consumption and rewarding them for conserving energy is far more effective than giving consumers information on how to reduce energy consumption or prompting them to conserve (Ester and Winett, 1981-82).

A recycling study also showed the positive effects of feedback on recycling behavior. In this study, 200 households were monitored for recycling behavior (i.e. how much material they set out in recycling bins on collection day.) The households were divided into several groups. Individualized recycling performance information printed on doorhangers was delivered weekly to one group of the households. Another group also received a weekly doorhanger, but with neighborhood data on collective recycling performance. A third subgroup served as the control and received no doorhanger at all. After nine weeks of observation, feedback techniques resulted in a 7% increase in frequency of participation and roughly 21% increase in the overall amount of recycled material collected. An additional result of this study showed that the collective neighborhood feedback was equally as effective as the individualized feedback. This is significant in reducing the necessary effort on behalf of the recycling coordinators in providing effective feedback (Oskamp, 1995). Feedback can have other positive effects on recycling performance as well. One study examined contamination of recycled materials due to incorrect sorting or lack of rinsing. They found that feedback techniques, in this case either postcards or newsletters, were effective in significantly reducing contamination of recycling bins in apartment complexes (DeYoung et al., 1995).

Another way of enhancing motives to recycle is by increasing the social pressure to recycle. As stated before, a prevalent reason that people recycle is because they have friends and neighbors who already engage in the activity. By providing a recycling role model, often called a block leader, within a community, social pressure to recycle increases. It is believed that the presence of a block leader may establish a social norm of recycling in a neighborhood (Schultz et al., 1995). Thus participating in recycling is one way of achieving social approval.

Several studies have looked at the effectiveness of block leaders in enhancing recycling behavior. Hopper and Neilsen implemented a block leader program on several blocks of a Denver, Colorado neighborhood. Block leaders who lived in the neighborhood were asked to contact their neighbors in person to tell them about the recycling program and to deliver reminders before each monthly recycling collection day. Several other blocks without block leaders were also monitored for participation. As predicted the blocks with the block leader programs significantly increased the number of times they participated in the program as compared to baseline data. No change in participation was seen on the blocks without the experimental intervention (Hopper and Neilsen, 1991).

Another study was done to assess the effects of volunteer recycling coordinators in apartment complexes. As in Hopper and Neilsen, volunteer coordinators were recruited from within the apartment complexes to disseminate information and generally encourage recycling behavior. The volunteer coordinator program was designed to mimic an already successful program in operation in neighborhoods of single family

homes in the same town. The results were contrary to what was expected. In the apartment complexes, volunteer coordinators did not increase recycling participation. The researchers speculated on several reasons for this result. In the single family home program, volunteer coordinators were especially useful in reminding neighbors of the recycling collection date. In the apartment complexes however, 105 gallon curbcarts stationed near the garbage dumpsters were used to collect recyclables for all apartments, making the pickup schedules irrelevant to the tenants. There is also the problem of high tenant turnover in apartment complexes, including the turnover, in some cases of the volunteer coordinators themselves. While acknowledging that the use of volunteer coordinators needed more study, the researchers recommended that volunteer coordinators not be used in apartment complexes as a strategy to increase recycling (De Young et al., 1992).

While volunteer coordinators may not be the right approach in apartment complexes, De Young et al. surmised that social pressure does still play a role in encouraging recycling. De Young et al. found that the size of the apartment complex made a significant difference in the level of recycling participation. As a rule, the smaller the complex, the more the residents recycled. Residents in the smallest apartment complexes (less than 10 units) consistently reported the most recycled material collected per apartment. The researchers speculated that the social pressure in a smaller complex may affect recycling participation. In a smaller complex, one is more likely to know and be affected by one's neighbors. Residents of smaller complexes often have more of a sense of ownership and involvement in the property. In larger complexes, however, there can be a greater sense

of anonymity among residents and thus less motivation to be involved in a community-based activity (De Young et al., 1992). Two other studies of multi-family housing recycling programs show similar results. A questionnaire distributed to multi-family housing residents in Portland, OR also revealed the importance of social pressure within a complex. Residents were asked to rate the "level of cohesiveness" in their complex's population. A positive association was found between perceived level of cohesiveness and reported level of recycling participation. The more cohesive the respondent felt their complex was, the more the resident was likely to recycle. Researchers for this study also looked at the impact of manager commitment to the recycling program. Manager commitment was determined by site visits and interviews which assessed the following factors for each apartment complex manager: operational responsibility; commitment to program success; active participation in monitoring program and assisting tenants and; interest in the program and recycling issues in general. Manager commitment was positively correlated with the complex's aggregate recycling level (Katzev et al., 1993). Benton and Fox also showed the importance of an actively involved apartment complex manager in their study in Seattle, WA. Recycling participation was measured by weighing the contents of recycling bins on each pickup day. Participation was found to be higher at an apartment complex whose manager had distributed recycling information personally to each resident than in a condominium complex in which flyers were simply left in mailboxes (Benton and Fox, 1990). It appears that the presence of an interested and active complex manager aided in encouraging participation in recycling. These results seem to counter the findings of De Young et al, who showed no impact on recycling behavior of volunteer coordinators within the complex. It may be that the

presence of an active authority figure such as the manager, may have more impact than simply a neighbor who has volunteered to coordinate recycling efforts.

Removing Barriers and Enhancing Motives for Waste Reduction Behavior

Although the value of waste reduction behavior is well known, considerably little research has been conducted in the effort to find effective methods of encouraging waste reduction behavior other than recycling. This may be because the results of most waste reduction studies are discouraging. Well-designed educational programs have repeatedly failed to show a demonstrated increase in waste reduction behavior.

A main problem in waste reduction research is the lack of methodology for effectively measuring waste reduction behavior. There are two approaches to measuring observable waste reduction behavior: input methods and output methods. Input methods measure changes in purchasing behavior. By examining shopping records, researchers have tried to find a trend towards less wasteful purchases in response to an educational intervention. Input methods, however, cannot account for any increases in at-home waste reduction behavior such as increased re-use of items. Output methods measure the change in the amount or weight of garbage put out for collection. While these methods will reflect both purchasing changes and at-home waste reduction behavior, there are many other possible confounding factors. Changes in household size, temporary changes in consumption patterns due to holidays or other events are just a few of the factors that can affect total garbage output but are unrelated to general waste reduction behavior. A

more specific measurement of garbage output involving combing through and measuring the contents of each household's garbage by category could be an effective tool. This method has been used for years by the Garbage Project of the University of Arizona to assess waste patterns in many communities (Rathje and Murphy, 1992). Unfortunately, no studies have been done to date looking specifically at the effect of waste reduction education on garbage output. This type of research is also expensive, time consuming and labor-intensive and thus not often used by researchers. A method that is used and has demonstrated results is the use of surveys to measure changes in reported behavior. As discussed before, a limitation of survey studies is the tendency to find overestimates of actual behavior due to a desire to appear to be "doing the right thing." Results of questionnaire studies, however, can give some idea of behaviors that are more commonly undertaken. A familiarity with these more common waste reduction activities may make them easier to encourage.

Another difficulty encountered in waste reduction behavior studies is finding the most appropriate method for dissemination of educational materials. With recycling, it makes sense to distribute information either in person or through printed materials to the target audience in their home where recycling initially takes place. Additionally, instructional signs on recycling bins provide further information at the location of the activity. Other types of waste reduction behavior take place in a variety of locations. Greater re-use of items will most often happen in the home, but purchasing behavior can occur in many places. Some people may plan their shopping lists at home while others assess their shopping needs at the grocery store. Shopping for higher-priced durable goods can often

involve comparing items between several stores. Getting the appropriate information to the consumer at the time of purchase can be nearly impossible.

This problem was examined by researchers who studied an environmental product tagging program in Illinois. A chain of local grocery stores was selected to receive the educational intervention. Products throughout these stores were selected for three different "environmental" features: 1) if the product's packaging was recyclable within the community; 2) if the product used less wasteful packaging or; 3) if the product was an alternative to others using more toxic chemicals. Shelf tags were installed on the shelves below each of the selected products indicating its environmental benefits over other brands. To complement the shelf-tagging program, store displays with brochures were placed in stores to explain the shelf tags and their significance. In addition, newspaper and television articles and educational programs in elementary schools were implemented to explain both the shelf tagging program and local recycling opportunities. It was hoped that consumers would be aware of the program before entering the store, and then be reminded of their choices as they pulled items off the shelves. Two hundred and forty-one (241) subjects were chosen randomly from neighborhoods located within a half mile radius of each store to complete phone interviews. The initial phone interviews were conducted soon after the introduction of the tagging program. Subjects were asked where they shopped most often. Those who reported shopping more than 10% of the time in one of the experimental stores were classified as "experimental subjects", whereas those who shopped more often in other local stores were classified as controls. Followup phone interviews asking the same questions were conducted up to a year later.

As expected, awareness of the shelf tagging program was significantly greater in the experimental subjects than in the control subjects. Up to 70% of experimental shoppers recognized the program whereas only 9% of the control shoppers knew of the program. Shoppers at the experimental stores were also more likely overall to report environmental shopping behavior than the control shoppers. Contrary to expectations, there was no change seen in self-reported environmental shopping behavior between the initial and follow-up interviews. The experimental shoppers reported the same levels of environmental shopping both before and after the year-long education program. The higher rate of reported environmentally responsible shopping behavior among the experimental shoppers may simply be due to a social desirability bias. The shelf tag program was implemented at least two months before the initial interviews, and may have affected interviewee responses. The experimenters concluded that the educational intervention had no effect on environmental shopping behavior (Linn et al., 1994).

A similar study conducted in Ulster County New York also assessed the effects of an environmental shopping educational campaign. This campaign instructed shoppers on the benefits of shopping in bulk to reduce packaging, purchasing of concentrated forms of products, and purchase of more durable as opposed to disposable goods. The study assessed various methods of educating consumers including in-store displays, direct mailings, supermarket tours and coupons for selected beneficial items. To measure change in shopping behavior, researchers used the scanned data from the store's shopper's club. Purchases of all members of the club were recorded electronically at checkout. Researchers then measured the weight of waste generated by those purchases

and assessed the data for changes before and after the educational intervention. Again, no change in shopping behavior was seen. The study concluded that broad-based consumer education efforts were unsuccessful in changing behavior in the short-term (Cornell, 2000).

Behavior change was reported in a study of general waste reduction behavior which examined the specific behavior rationales. Shoppers in Chelsea, MI were recruited to take part in a 13 week study. The study included a pre-intervention survey, distribution of educational pamphlets on waste reduction and a post-intervention survey. The shoppers were divided among four treatment groups. A control group received only the two surveys. The other three groups also received pamphlets that differed only in the rationale given for reducing waste. One group received pamphlets promoting environmental reasons for reducing waste, another received pamphlets with economic reasons and the third received pamphlets which included a combination of environmental and economic reasons to reduce waste. The researchers found a significant increase in reported waste reduction behavior over the 13 weeks for all three of the experimental groups. This study was subject to a social desirability bias, in which the subjects may have overestimated their waste reduction behavior in the final survey. In order to corroborate the survey data, the researchers attempted to collect shopping receipts from the subjects to analyze for observable shopping behavior changes. Unfortunately, the receipt data received was incomplete, and accounted for less than 50% of actual purchases, making an accurate analysis impossible. Nevertheless, it is interesting to note that while all three experimental conditions led to increases in waste reduction behavior,

the group which received the combined environmental and economic rationale pamphlets showed the greatest increase. This increase was significantly greater than either the environmental reasons only group or the economic reasons only group, indicating an additive effect of the two rationales in promoting waste reduction behavior (De Young et al., 1991).

Chapter 3: Study Design

Scope of the Project/Choosing an audience

For this project, I chose to limit my target audience to a single apartment complex. Obviously, to achieve an overall effect on the life of the landfill, a comprehensive effort would have to be implemented for all of Missoula, but this type of effort is certainly beyond my current means. Instead I chose to pursue a pilot project for one segment of the population - the multi-family housing market. Different audiences require different approaches to achieve successful waste reduction. The multi-family housing market has its own set of challenges and is often left out of waste reduction programs. Recycling programs specifically tend to cater to single family homes. In Missoula, BFI offers a free curbside service to households through their Blue Bag program and Missoula Valley Recycling also offers a monthly pickup service for households for a nominal fee. While both these services are available to multi-family housing units, they are rarely utilized. Part of the reason for this is that garbage pickup service is usually the responsibility of the housing complex manager or owner and is not under the resident's control. Therefore, the residents have less access to information about recycling services available to them and relatively no ability to request the recycling services they would prefer. In addition, the multi-family housing market in Missoula is quite large. Approximately 17% of households within the city limits are located in structures containing five or more units (Bureau of the Census, 1990). A demonstration project showing the feasibility and benefits of increasing recycling and reducing waste in a single

apartment complex would be helpful to encourage the behavior in other complexes citywide.

I conducted the pilot project at the Rozale Apartments located at 336 S. 6th St. W., Missoula, MT. For my control site, I chose the Alpha Arms Apartments located at 130 W. Kent St., Missoula, MT. The Rozale Apartment complex has 22 units, comprised predominantly of 1-bedroom and studio apartments. According to the managers, the building normally has 100% occupancy. The Alpha Arms Apartment complex is slightly larger with 28 units, mostly 1-bedrooms except for two 2-bedroom apartments. Occupancy rates vary but there are usually several vacant apartments. Each apartment complex has one 3-cubic yard dumpster that is picked up once per week. Neither complex had on-site recycling bins at the start of the project, although the Rozale apartments did have a place for the recycling of cardboard.

Figure 1: Site Photos

Rozale Apartments, 336 S. 6th St. W. Missoula, MT

Dumpster and Recycling Bins, Rozale Apartments

Designing the Study

Based on the research discussed in the behavior change literature review, this study attempted to incorporate the most persuasive techniques that were feasible to change recycling and waste reduction behavior in an apartment complex in Missoula. First, the study sought to reduce some of the barriers to recycling. Five 50 gallon recycling bins were placed on-site at the complex adjacent to the garbage dumpster. The location of the bins reduced the distance residents had to transport their recyclables thereby increasing the convenience of the activity. The bins also provided a visual reminder to recycle each time the residents threw away their garbage. Bins were provided to collect two types of plastic, newspaper, aluminum and steel cans. The area between and behind the bins was designated as a collection place for cardboard. Unfortunately, due to the fluctuating costs of collecting glass in Missoula, it was necessary to omit glass recycling from the program. This omission decreased the total amount of recyclable material which could be diverted from the landfill.

In order to reduce the barrier caused by lack of information, several techniques were used. A flyer with clearly written recycling instructions was provided to each resident, explaining the six types of materials which could be recycled and how to prepare them for recycling (See Appendix A). The recycling information flyer also included specific facts about recycling in Missoula, including information about where the collected materials are taken to be recycled, and how they are used again in new products. This information was included to diminish mistaken perceptions that the collected recyclable materials were not being recycled. The flyer included a phone number for Missoula

Valley Recycling if additional information was needed. Signs on the bins were also used to convey recycling information. Each bin was clearly marked with a permanent laminated sign indicating the type of material to be placed in the bin. The bin signs also included information on how to prepare the recyclable materials and the phone number for Missoula Valley Recycling.

This study also used techniques devised to enhance the motives for recycling. Since the predominant motive for recycling is that it is good for the environment, specific facts about the environmental benefits of recycling were provided to residents. This information was included on the back of the recycling information flyer and on laminated signs on the lids of each recycling bin. The information included general facts about the benefits of diverting waste from the Missoula landfill, but also focused on the beneficial effects of a single individual's recycling efforts. It was hoped that this information would help provide the tenants with an intrinsic satisfaction when they recycled.

Social pressure is another important motive to recycle. This study used some social pressure techniques while avoiding others. It was important to show the tenants that the apartment managers were involved and supportive of the recycling program. Therefore, the recycling information flyer was accompanied by a brief note from the managers introducing the recycling program and encouraging their tenants to participate (See Appendix B). I did not ask the managers to visit the tenants personally, nor did I arrange for in-house volunteer coordinators to promote recycling. While both techniques might have encouraged more recycling participation, it was important to ensure that the

methods of this study could be replicated easily in another apartment complex. The methods were designed to be low-cost and require little effort on behalf of the apartment complex managers. It was hoped that this low maintenance design would make the recycling program easier to market to other apartment complexes. This design does risk losing the higher participation rates which might accompany a more intensive and personalized program.

Tenants were given feedback on their recycling behavior at one stage of the recycling program. Two months after the recycling flyers were distributed, a note was distributed to all tenants congratulating them on their efforts and providing a tally of the total amount of recyclables collected thus far in the program (See Appendix C). The note provided a "pat on the back" to those who were recycling, and a reminder to those who were not participating. The note also showed the impressive efforts of the recyclers. In just two months they had collectively diverted a full dumpster's worth of recycled materials from going to the landfill.

In order to promote waste-reduction behavior other than recycling, an informational brochure was given to the tenants along with the congratulatory feedback note (See Appendix D). The brochure explained both the ecological and economic benefits of waste reduction and gave several easy examples of ways to reduce household waste. Ecological benefits included the diversion of waste from the landfill and reduction of pollution. The economic benefits were outlined with comparisons of actual costs to consumers of more and less wasteful purchases. The brochure was intended to

encourage waste reduction behavior by appealing to the needs of budget-conscious consumers while providing the intrinsic satisfaction of "doing the right thing". The brochure also suggested several simple action strategies tenants could easily adopt to reduce their waste. A postcard addressed to the Direct Marketing Association was included to encourage residents to reduce the amount of junk mail they received. A limitation of this part of the study was that only the easiest action strategies were included in the brochure. While more complex actions might reduce more waste, the brochure was intended to show that minimal changes in one's daily lifestyle could reduce waste. Simply using a brochure to suggest major lifestyle changes was unlikely to be effective. More interactive techniques for teaching waste reduction behaviors conflicted with the original intent to keep the recycling and waste reduction program simple and inexpensive.

To assess the effects of the recycling and waste reduction program, two types of data were collected. The volume of recycled materials in the bins was measured on the morning of the biweekly recycling pickup. The estimated volume of garbage in the dumpster was also measured on the morning of the weekly garbage pickup. By measuring both the amount of recycling and the amount of garbage collected I was able to more accurately assess the effect of the program. The recycling data measured collective recycling participation, while the garbage data reflected waste diversion efforts due to both recycling and other types of waste reduction. There were several limitations to the data I was able to collect. For one, I was only able to collect the volumes of recyclables and garbage, not their weights as often used in other studies. Neither

Missoula Valley Recycling nor BFI measure the weight of the refuse collected, and I had no feasible method of being able to do so on-site. Also, there was no way to distinguish the effects of the waste reduction information separately from the effects of the recycling program. Measuring the change in volume of waste in the dumpster over time reflected the effects of waste diversion associated with both aspects of the program together.

Data Collection Methods

Baseline Data Collection:

Baseline garbage volume data was collected for one month prior to the start of the pilot project. The level of garbage in each dumpster was recorded each week early in the morning of the pickup day. Garbage level was measured in relation to the top of dumpster (e.g. full and overflowing, full, not quite full, 6 inches below full or 1 foot below full.) No evidence of on-site recycling (i.e. no Blue Bags set out by dumpster) was recorded at the Alpha Arms. Some cardboard was put out for collection at the Rozale apartments.

Experimental Data Collection:

Garbage volume data was collected weekly for four months using the same procedure used to collect the baseline data.

At the Rozale apartments, recycling bin volume data was collected bi-weekly early in the morning of the pickup day. The level of recyclable material was measured relative to the

the top of the bin (e.g. full bin, ¾ full, ½ full, ¼ full or empty.) Cardboard recycling was observed each week, but due to the lack of a practical way of measuring cardboard volume, data was not collected.

Data Conversion:

In order to calculate the volumes of garbage and recyclable materials recorded, dumpster and recycling bin levels were converted to cubic yards as follows:

Dumpster Level:	Garbage Volume (cubic yards):
Full and overflowing	3.125
Full	3
Not quite full	2.875
Six inches below full	2.45
One foot below full	2

Recycling Bin Level:	Recycling Volume (cubic yards):
Full	.5
¾ Full	.375
½ Full	.25
¼ Full	.125

Chapter 4: Results and Analysis

Results

Weekly dumpster volume was collected at the Rozale Apartments and the control site each Monday morning between February 14th and July 31st, 2000. (See Table 1) The first five weeks of data comprised the baseline dumpster volume data before the recycling and waste reduction program was introduced. The results of the baseline data show that despite fluctuations from week to week, the two sites initially had similar average weekly garbage volumes. The control site had a slightly larger average volume of 2.965 cu. yds, while the Rozale Apartments' average weekly volume was 2.825 cu. yds.

After the recycling and waste reduction program was implemented at the Rozale site, the average weekly dumpster volume at the Rozale apartments declined to 2.701 cu. yds, a decrease of 4.38%. As expected, the control site showed little change in average weekly dumpster volume over the same time period. A slight increase of .25% was seen with an average weekly dumpster volume of 2.972 cu. yds at the control site. (See Table 2)

While the aim of the project was to achieve a greater rate of waste reduction at the Rozale Apartments, these results may be deceiving given some unusual circumstances during the experimental period of this project. In the three months of data collection, there was an unusually high turnover of tenants at the Rozale Apartments. The building usually experiences some turnover, particularly in May and June at the end of the academic year, but normally no more than two or three apartments. This year, however,

the building experienced an unprecedented turnover of ten of the twenty-two apartments in the building. Generally, tenants produce a considerable amount of excess garbage when they move in or out of an apartment. It can be seen as quite an achievement of the waste reduction and recycling program that the average weekly dumpster volume still decreased during this time.

Clearly, a large portion of the dumpster volume reduction can be attributed to the diversion of waste to the recycling bins. As table 3 shows, recyclable materials were collected consistently between April 19, 2000 and July 19, 2000. The bins collected an average of .938 cu. yds of recyclables at each bi-weekly pickup. A total of seven cu. yds of recyclables were collected over the duration of the project. This total included 2.5 cu. yds. of newspaper, .625 cu. yds of steel cans, .875 cu. yds. of aluminum cans, 1.125 cu. yds of plastic #1 bottles, and 1.875 cu. yds of plastic #2 bottles. When these volumes are converted to weights, the total comes to between 1,117 and 1,513 pounds of recyclables, which is more than half a ton! Cardboard boxes were also collected during this time although they were not included in the calculations due to a lack of methods for measuring cardboard volume. Therefore, the calculation of seven cu. yds actually underestimates the total volume of recyclable materials collected.

The effectiveness of the program can be seen in several ways. For one, recyclable materials were continuously collected throughout the duration of the project. While it cannot be determined exactly how many of the residents were recycling, the large volume of recyclable materials collected indicated that quite a few of the residents were

participating. When the experimental period of the study had finished, a sign-up sheet was posted on the first floor of the building to assess interest in continuing recycling at the Rozale Apartments. Residents of nine of the 22 apartments signed up, all of whom were willing to pay part of the costs to continue the recycling program. Secondly, the sorting of the recycling materials was done exceptionally well. When Missoula Valley Recycling finds a bin of recyclables that has been sorted incorrectly or otherwise contaminated, they leave the bin behind with a note indicating the contamination problem. In the three months of data collection, not a single bin of recyclables was ever turned away by Missoula Valley Recycling. It seems that the information provided in the flyers and on the signs on the bins clearly explained the sorting and preparation procedures which prevented common contamination problems.

Unfortunately there was no method for specifically measuring the effects of other waste reduction activities that may have been taking place at the Rozale Apartments. Ideally one would be able calculate the volume of other waste reduction activities by taking the total waste volume diversion (i.e. the total dumpster volume decrease) and subtracting the total volume of collected recyclable materials. However, due to differing rates of density and compaction between the dumpster and the bins, the two sets of volume data are not comparable.

Table 1: Observed Dumpster Volumes at Rozale Apartments and Control Site.

Date	Control Dumpster Volume (Cu. yds.)	Rozale Dumpster Volume (Cu. yds.)
Baseline Data		
2/14/00	3.125	2.000
2/21/00	3.125	3.000
2/28/00	2.450	3.125
3/13/00	3.000	3.000
3/20/00	3.125	3.000
Recycling Bins Introduced at Rozale		
3/27/00	2.450	2.450
4/3/00	3.000	2.000
Recycling Flyers distributed at Rozale		
4/10/00	3.125	2.875
4/17/00	3.000	2.450
4/24/00	3.125	2.875
5/1/00	3.125	2.875
5/8/00	3.125	2.875
Waste Reduction Flyers distributed at Rozale		
5/15/00	3.250	2.875
5/22/00	2.875	3.125
5/29/00	3.000	3.125
6/5/00	3.000	3.000
6/12/00	3.000	2.450
6/19/00	2.450	3.000
6/26/00	3.000	3.000
7/3/00	2.450	2.450
7/10/00	3.125	2.000
7/17/00	3.125	2.450
7/24/00	3.125	2.450
7/31/00	3.125	3.000

Table 2: Average Weekly Dumpster Volumes at Rozale Apartments and Control Site

	Control Dumpster Volume (Cu. yds.)	Rozale Dumpster Volume (Cu. yds.)
Baseline Average	2.965	2.825
Experimental Average	2.972	2.701
Difference (cubic yards)	0.007	-0.124
% Difference	0.25%	-4.38%

Figure 2: Average Weekly Dumpster Volumes at Rozale Apartments and Control Site

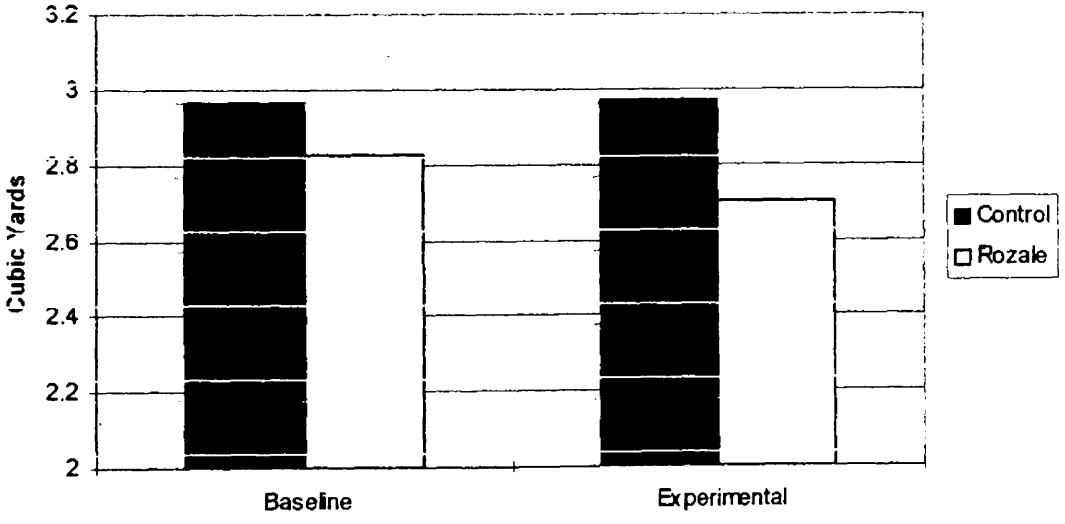


Table 3: Observed Recycling Volumes at Rozale Apartments

Date	Newspaper	Steel Cans	Aluminum Cans	Plastic #1	Plastic #2	Total
	(Cubic Yards)					
4/19/00*	0.375	0.000	0.000	0.375	0.125	0.875
5/3/00	0.250	0.125	0.250	0.125	0.500	1.250
5/17/00	0.250	0.125	0.125	0.250	0.500	1.250
5/31/00	0.250	0.125	0.125	0.125	0.250	0.875
6/7/00**	0.250	0.000	0.000	0.125	0.125	0.500
6/21/00	0.500	0.125	0.125	0.125	0.125	1.000
7/6/00	0.375	0.000	0.125	0.000	0.125	0.625
7/19/00	0.250	0.125	0.125	0.000	0.125	0.625
Total	2.500	0.625	0.875	1.125	1.875	7.000
Average Bi-Weekly Volume***	0.313	0.104	0.146	0.104	0.271	0.938
Total Weight (1)	900-1,263 lbs.	94 lbs.	44-66 lbs.	34-45 lbs.	45 lbs.	1,117-1,513 lbs.
Average Bi-Weekly Weight (1)	113-158 lbs.	16 lbs	7-11 lbs.	3-4 lbs.	7 lbs.	146-196 lbs.

* This pickup occurred after five weeks of collection.
** This pickup occurred after only one week of collection.
*** Does not include data from 4/19/00 or 6/7/00.
1. Weight determined by using volume-to-weight conversions for each category of material. (USEPA, 1993)

Analysis

Was the recycling and waste reduction pilot project worth the effort? From a financial standpoint, the project did not yield substantial cost savings. (See Figure 3) The cost of recycling pickup by Missoula Valley Recycling was $13 per pickup. Given the amount of recyclable materials collected it was determined that a single monthly pickup was sufficient. Thus, the total cost for one year of recycling pickup would be $156.00. The aim of the project was to offset this cost by reducing enough waste at the Rozale apartments to allow the use of a 2 cu. yd. dumpster. Using a 2 cu. yd. dumpster instead of the 3 cu. yd. dumpster would result in $114.72 in savings. This would require a waste reduction of 27% (.82 cu. yds per week). Unfortunately, the recycling and waste reduction program only created a 4.38% waste volume reduction. Therefore the apartment complex could not switch to a 2 cu. yd. dumpster. In addition, there were upfront costs of $145.44 for implementing the program (including the printing charges and the cost of the bins).

There were potential cost-savings seen in the avoidance of additional garbage charges. BFI charges $3.50 per additional cu. yd. of waste that is left for pickup outside the dumpster (i.e. when the dumpster is already full). Prior to the waste reduction and recycling program, the Rozale apartments had sporadic additional charges. During the three months of the recycling and waste reduction program, BFI did not assess any additional charges for pickup at the Rozale apartments. It is important to note that additional charges may have been very likely during the experimental period due to the excess garbage from the turnover of apartment tenants.

From an ecological standpoint, the recycling and waste reduction program was a success. Over the duration of the program seven cu. yds of recyclable materials weighing over half a ton were diverted from going to the landfill. The continuation of the recycling program implies that many more recyclable materials will be added to this total over the next year. The reuse of these materials will lead to savings in energy, conservation of natural resources and prevention of pollution. Although it is difficult to verify, other waste reduction activities may have occurred as well. The waste reduction brochure gave several concrete suggestions on ways to reduce household waste. If followed, these suggestions may have contributed to the waste reduction observed at the Rozale Apartments as well.

The program was also a success from a sociological standpoint. About twenty-five residents were educated, or at least exposed to information about how and why to recycle in Missoula. These residents were also introduced to concrete waste reduction strategies which would save them money. It is possible that the only residents who participated in the recycling and waste reduction program were those who were already participating in these activities on their own. However, this seems unlikely given the rate of waste reduction that was seen during the data collection period, a time when waste production should have risen. This means it is very likely that the behavior of some of the residents in the apartment complex did change. Residents who were not previously recycling probably began engaging in the activity. There may have been residents who expanded the number of items they regularly recycle due to the convenience of the five different bins. Some residents may have shopped differently, choosing to purchase items which

reduced waste. One resident I spoke with, who had recycled regularly even before the program began, indicated that she believed she was recycling more than she used to. Having the bins outside the building made recycling so easy that she was less likely to throw away the occasional item she could not be bothered to store. Additionally, the tenants were provided with specific information about the environmental benefits of their participation. This has hopefully provided these tenants with an intrinsic satisfaction that will help maintain their participation in the future. Given the relative simplicity of the program, which was designed to require minimal effort on the part of the apartment complex manager, these results are encouraging.

Figure 3: Project Costs and Potential Savings From Reducing Waste

Project Costs

Recycling Bins	
Six 50-gallon recycling bins @ $18.99 each	$113.94
Printing Costs	
22 copies of double-sided recycling flyer @ $0.16 each	$ 3.52
Lamination of signs on bins	$ 15.00
22 copies of waste reduction brochure @ $0.23 each	$ 5.06
22 Stop Junk Mail postcards @ $0.36 each	$ 7.92
Total Printing Costs	$ 31.50
Total Upfront Project Costs:	**$145.44**
Projected Yearly Recycling Pickup Costs	
Monthly recycling pickup @ $13.00 per month	**$156.00**

Potential Savings from Reducing Waste

Projected Yearly Garbage Costs	
Weekly pickup (3 cu. yd. dumpster) @ $76.43 per month	$917.16
Weekly pickup (2 cu. yd. Dumpster) @ $66.87 per month	$802.44
Yearly savings from reducing waste to 2 cu. yds. per week	**$114.72**

Garbage Pickup Surcharge Costs	
Per cu. yd. additional garbage outside of full dumpster	$ 3.50 per event
Savings per additional cu. yd. avoided through waste reduction	**$ 3.50 per event**

Conclusion

This project showed that recycling and waste reduction behavior among residents in an apartment complex can be changed through a simple program of providing appropriate information and convenient facilities. The calculated change in behavior that resulted from this study was not enormous. The observed waste volume was reduced by only 4.38%. Conservative estimating techniques used in this study may have contributed to the low waste reduction rate. It is possible that the density of the waste in the dumpster was much lower, but that the decrease was not evident from the observable waste volume. Nevertheless, given the data I collected, I could not recommend a change at the Rozale Apartments to the use of a 2 cu. yd. dumpster. This change would have provided a major financial motive for other apartment complex managers to implement the recycling and waste reduction program. The program did create some cost savings through the avoidance of BFI surcharges for additional waste. For an apartment complex that frequently pays these surcharges, the recycling and waste reduction project might be more attractive financially.

The real effects of implementing this program at the Rozale Apartments go beyond cost savings however. The program generated enough interest among tenants that a core few have dedicated themselves to continuing the program. Based on the response to a sign-up sheet posted on the first floor of the building, this core group has the support of the tenants of at least nine apartments who are willing to help pay for the recycling program. The core group is currently collecting money from the other tenants in the building, and will continue to distribute recycling information to current and new tenants. The

continuation of this program by the residents themselves is perhaps its greatest success. This means that in addition to the one-half ton of recyclables already collected through this program, possibly several tons more could be collected in the next year. The diverted recyclable materials will be creating more landfill capacity here in Missoula and will contribute to energy savings, conservation of natural resources and pollution prevention in the places where they are reused.

The fact that the tenants chose to continue and pay for the recycling program is an exciting result. Apartment complex managers may be more likely to become Missoula Valley Recycling customers knowing that tenants are willing to pay some of the costs. The longevity of a recycling program organized by tenants, however, is at risk. Turnover of apartment tenants, including the core group of organizers, is likely to occur. There is no guarantee that these residents will find replacements for themselves to continue the program. I had hoped the apartment managers at the Rozale Apartments would take on the responsibility of the recycling program, given the ease of administration, and the potential financial benefits. This would certainly reduce the risk created by turnover of tenants. They decided they would only allow recycling to continue if the tenants agreed to organize and pay for the program themselves. A major reason for this decision was the managers' experience with recycling at the Rozale Apartments in the past. Several years ago an enthusiastic tenant collected money from other tenants and set up a recycling program. While he maintained the program it was successful and the managers were pleased with it. Once he left the building, the program fell apart. The area around the bins became messy without the recycling coordinator to straighten it out. Tenants were

not sorting their recyclables properly which added to the mess. The recycling bills were more expensive than previously thought due to an additional cost per pound of glass that was charged at the time. Apparently the recycling coordinator had been subsidizing the program to keep it going. The effort required to fix the recycling program was considered too great and the program was stopped. The recycling program I created was designed to avoid many of these problems. I chose not to include glass in the recycling pickup, to ensure a stable monthly cost for the program. The bins were clearly labeled and instructional flyers were distributed which helped tenants sort their materials correctly. With the exception of occasionally straightening out some cardboard, the recycling area needed very little attention to keep it tidy. Nevertheless, the apartment complex managers at the Rozale Apartments were more heavily persuaded by the results of the past.

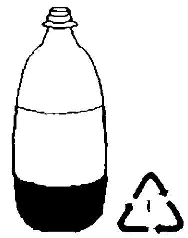
For new apartment complex customers, I believe the results of this study can be used by Missoula Valley Recycling. The results demonstrate that a simple, convenient design will lead to recycling by tenants and reduction of waste overall. Appropriate signs and instructional information can prevent improper sorting of materials, contamination of bins and the resulting mess that can ensue. While active encouragement of tenants would likely improve the results, little effort was required to maintain continued participation. There were some financial benefits to implementing the program as well. Costs for excess garbage pickup by BFI were avoided during the experimental period of the study. All of the above results should be conveyed to potential new customers. I also recommend that Missoula Valley Recycling emphasize the environmental benefits

of implementing the program. Explaining that an apartment complex manager can divert more than half a ton of recyclable materials away from the landfill in just three months, can be a persuasive argument. The energy savings and pollution prevention benefits associated with the reuse of these materials are convincing as well. The apartment complex manager should be encouraged to implement and manage the program with the knowledge that he is likely to find support among the tenants. Having a non-tenant coordinator will help ensure a long-lasting and worthwhile recycling and waste reduction program.

The success story of the Rozale Apartments demonstrates the collective impact Missoula Valley Recycling and apartment dwellers can have on waste reduction in Missoula. The replication of this program at other apartment complexes throughout Missoula would be both simple and feasible. By using the results of this study to encourage new customers Missoula Valley Recycling could play a large part in facilitating a reduction in the amount of waste sent to the Missoula landfill. This reduction is beneficial now and will be especially helpful in the future as the landfill fills and our waste disposal options become limited and more expensive.

Appendices

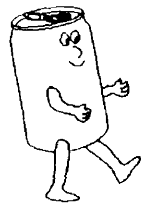
Plastic #1



Clear plastic bottles only. Look for the Plastic #1 symbol on bottom of bottle. Please rinse bottles and remove caps!

No plastic bags or colored plastic. Thanks!

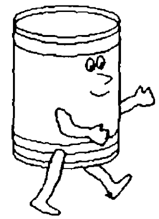
Aluminum



Put rinsed aluminum cans, food trays or clean aluminum foil in this bin.

No heavily soiled aluminum foil please!

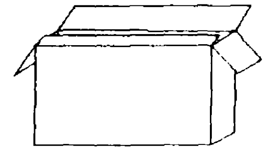
Steel Cans



Please rinse out steel cans!

No spray cans, paint cans or wire hangers please!

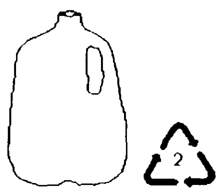
Cardboard



Please flatten all boxes and insert between containers. Both corrugated and flat cardboard (like cereal boxes) can be recycled.

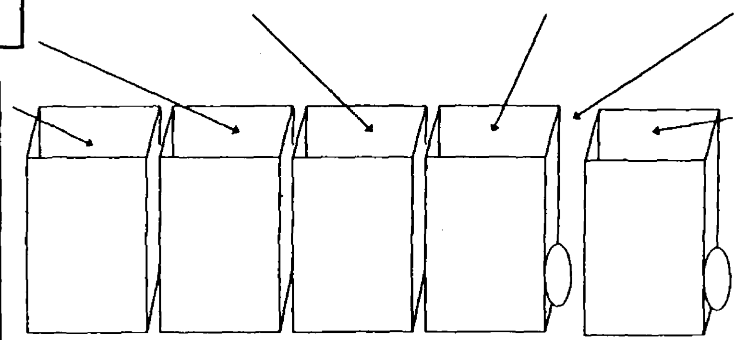
No white cardboard or waxed boxes (like butter or frozen food boxes.)

Plastic #2

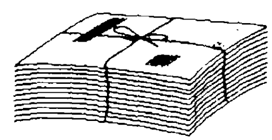


Opaque plastic bottles only. Look for the Plastic #2 symbol on bottom of bottle. Please rinse bottles and remove caps!

No colored plastic, tubs or buckets please.



Newspaper



Put newspaper, ads/inserts that come with the paper in this bin.

No magazines or other kinds of paper.

HOW TO RECYCLE

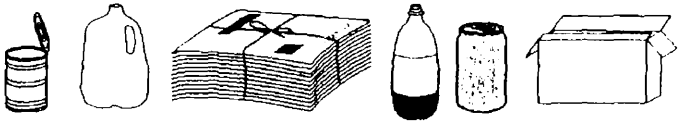
Recycling Pickup Service provided by:

Missoula Valley Recycling
PO Box 9458, Missoula, MT 59807
543-2972

Recycling Guarantee
All items placed in these bins will be brought to the BFI Recyclery to be recycled. Our trucks do not go to the landfill!

The items listed here are those included in our apartment recycling program.
If you would like to recycle other items please contact the BFI Recyclery at 721-1120.

One person can make a difference!



It's easy to do!

WHY RECYCLE IN MISSOULA?

Recycling is especially important in Missoula!
The life of our landfill is limited. The less garbage we put in it, the longer it will last....and the less it will cost all of us in the long run. Recycling is a great way YOU can help extend the life of the landfill.
It has other terrific benefits too!

Saves Energy!

Using recycled aluminum saves 95% of the energy needed in production. You save enough energy by recycling a single can to power a TV for 3 hours!!

Saves Resources!

Recycling 1 ton of newspaper saves: 17 trees
6953 gallons of water
463 gallons of oil
4077 Kilowatts of energy
3.06 cubic yds of landfill space!

Prevents Pollution!

Making new steel products from recycled steel instead of virgin materials reduces water pollution by 76%, air pollution by 76% and mining wastes by 97%!

Recycling Really Works!

All the cardboard collected gets recycled right here in Missoula. The Stone-Smurfit plant uses it to make new liner board. Our old newspaper is made into new paper by a Weyerhauser plant in Oregon.

Reduces Greenhouse Gases!

Decomposing garbage in the landfill produces methane - a greenhouse gas. If everyone in Missoula County recycled just 1/2 of their newspaper, cardboard, bottles and cans regularly, it would be like taking 4500 cars off the road for the whole year!

Saves Landfill Space!

Missoula's landfill manager estimates that 75% of the garbage that gets dumped could be recycled. Currently only 6% of Montana's waste gets recycled.

Printed on recycled paper.

Graphics courtesy of Wisconsin Dept. of Natural Resources

Appendix B: Notice to Tenants

Introducing RECYCLING at the Rozale Apartments!
You may have noticed the brand new recycling bins outside by the dumpster. They have been put there by Missoula Valley Recycling who will come by and pick them up every two weeks. Our building is part of a demonstration project that will continue until June. At that point we will measure the success of the project and make a decision about our further participation.
Here is a informational sheet which illustrates which materials can be recycled, and how to prepare them. Keep it handy (on the fridge, in a drawer) so you'll always have the information you need.
Thanks for participating in this important program!

Jeff & Sheila

Appendix C: Feedback Notice

Congratulations! The recycling program at the Rozale Apartments is off to a great start!

In just a few short weeks you have collectively recycled the equivalent of **a whole dumpster full** of recyclables. This means that a dumpster's worth of garbage has been saved from going to our Missoula landfill. And the materials collected will be recycled into new products saving lots of energy and preventing pollution!

To help further reduce your waste, here is a brochure with handy tips and ideas that can save you money. We've also included a postcard which you can send off to get your name off all those junk mail mailing lists.

Thanks again for your cooperation!

Missoula Valley Recycling
543-2972

Avoid Disposables

Don't throw your money away! Disposable products can be very expensive over time!

Using **cloth towels and napkins** more often can make a roll of paper towels last weeks longer!

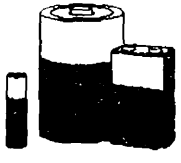
For leftovers, use **containers with lids** instead of foil or plastic wrap.

Durable plates and cups can be used again and again. You only have to buy them once which saves you money!!

Use **rechargeable batteries** for your portable electronic devices.

Example
50 packs of 4 AA batteries $199.50
1 pack of 4 AA rechargeable batteries and recharger ..... $ 16.50
You pay $183.00!!

196 used batteries go to the landfill (and you make lots of trips to the store!)



Reduce Junk Mail

The average American spends eight months of their life sorting junk mail. And junk mail adds up to a large part of the unnecessary garbage we throw away.

To **get your name removed from general mailing lists**, register with the Direct Mail Association Mail Preference Service. Send your name and address to:

DMA Mail Preference Service
P.O. Box 9008
Farmingdale, NY 11735-9008

Give it Away

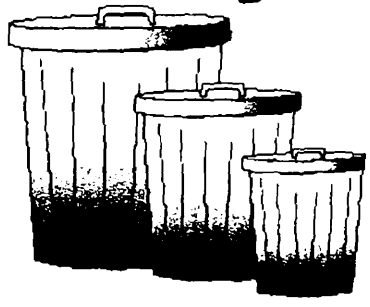
If you have items you don't want that can still be used by someone else, give them away instead of throwing them away.

If your friends don't want them, you can donate useful items to:

Goodwill Industries	The Salvation Army
2300 Brooks	339 W. Broadway
549-6969	721-3852

Graphics courtesy of WI Dept. Of Natural Resources.
Printed on recycled paper.

Shrink Your Garbage!



It'll help the environment and save you money!

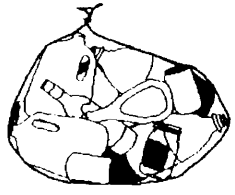
Household Waste Reduction Tips for Missoula

Missoula Valley Recycling
P.O. Box 9458
Missoula, MT 59807
(406) 543-2972

Recycle

Every year the typical American household discards:

13,000 paper items,
1,800 plastic items,
500 aluminum cans, and
500 glass bottles!!



Many of these items can be recycled instead of thrown away. This will help Missoula's landfill last a lot longer. Making new products from recycled materials also saves energy, natural resources and prevents pollution!

For more information about recycling in Missoula contact:

Missoula Valley Recycling: 543-2972
BFI Recycling: 721-1120
Pacific Recycling: 543-7280

Reduce Packaging

Over one third of our household garbage is made up of containers and packaging materials - most of which gets thrown out immediately after use.

You can reduce the amount of packaging you consume by shopping carefully!

Look for **products that come with less packaging** and thank store managers for stocking them.

Buy concentrates where available (more stuff, less packaging)

Example:
½ gallon container of orange juice.....$3.00
Frozen juice concentrate...$1.50
You pay: $1.50 more!

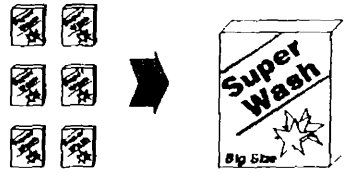
...and one large plastic or cardboard container goes to the landfill!

Buy in Bulk

Buy **products in larger sizes.**

Example:
5 small boxes of laundry soap (good for 20 washes each) $25.45
Super size box of laundry soap (good for 100 washes).....$18.99
You pay: $6.46 more!

...and four extra boxes get thrown away!



Look for **products that are available in refillable packages.**

The Good Food Store sells many products in bulk that you can purchase in reusable containers.

Example:
18 oz. canister of oatmeal....$2.29
18 oz of bulk oats.....$ .55
You pay: $1.74 more!

...and you can't reuse the container you bought it in when you run out!

Appendix E: Reduce Junk Mail Postcard

I want to stop receiving junk mail!

To whom it may concern:

I am writing to request that my name and address be removed from any mailing lists in your reach. Please register my name with the Mail Preference Service.

NAME: _____
STREET: _____ **APT#:** _____
CITY: _____
STATE: _____ **ZIP CODE:** _____ - _____
SIGNATURE:
_____

MAIL PREFERENCE SERVICE
DIRECT MARKETING ASSOCIATION
P. O. BOX 9008
FARMINGDALE, NY 11735-9008

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